

Tuberculosis Resurveys of Patients In California Mental Institutions

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THE STEADY DOWNWARD trend of the tuberculosis death rate reached in 1950 a new low rate of 23 per 100,000 population in the United States and 21 per 100,000 in California. The tuberculosis death rate among the hospitalized mentally ill in California was 482 per 100,000 in 1950 and 366 per 100,000 in 1951; it had been as high as 800 in 1946 (table 1). Although the average population in the mental hospitals in 1950 represented only 0.3 percent of the total population of the State, deaths from tuberculosis among patients in mental hospitals constituted 5.5 percent of all tuberculosis deaths in California. Associated with this very high tuberculosis mortality is a prevalence which is many times higher than that of the general population, as revealed by X-ray surveys (1). Mental institutions as a group thus constitute probably one of the largest remaining reservoirs of tuberculosis (2).

Although mentally ill patients are more or less separated from the general population, they cannot be isolated completely. Home visits are

rather frequent and hospitalized patients have contacts with visitors, relatives, and employees of the institution. An increasing proportion are being paroled or discharged. In California, the mentally ill patient with active tuberculosis who no longer requires hospitalization for psychiatric treatment cannot be detained in the mental hospital by reason of his tuberculosis. Hence, the tuberculous, mentally ill patient must be considered an epidemiological factor requiring serious consideration.

Case finding is the first essential in tuberculosis control programs in mental institutions. The initial X-ray survey must be rapid and complete with immediate followup of every suspicious finding, classification by X-ray supplemented by clinical and laboratory investigation, and effective segregation and treatment. Criteria for segregation should be based not merely on the frank activity of the tuberculous lesion but also on the tendency of supposedly quiescent or inactive lesions to reactivate, thus constituting foci of infections to others. Plunkett and his associates highlighted this danger of reactivation which, unquestionably, is a more frequent occurrence than is generally realized (3). He reported an "epidemic" of 9 new cases of clinically significant tuberculosis which he attributed to contact with a boy who had a reactivation of supposedly arrested tuberculosis after he had been transferred from the tuberculosis ward to one of the general wards. A similar outbreak of tuberculosis was reported

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in an Ontario mental hospital where 50 new cases suddenly developed in a building in which the situation apparently had been under control (4). Thirty-nine of these patients had positive sputum. The source of infection was not identified. In our own experience, reactivation has proved to be a factor requiring constant vigilance (5).

To allow the tuberculosis control program to lapse after completion of the initial survey, followup, and segregation is to lose most of what has been gained. It was the conviction of those associated with our initial survey in 1946 that the program should follow these lines: (a) centralization in one institution of all tuberculous patients requiring segregation, as soon as facilities could be provided and, in the meantime, as efficient segregation in each institution as possible; (b) treatment of both the tuberculosis and the mental condition; (c) X-raying of all newly admitted patients, with immediate segregation when needed; (d) periodic X-ray and laboratory check of both segregated and unsegregated tuberculous patients; (e) establishment of a modified contagious disease technique for active cases; (f) frequent chest X-raying of employees caring for tuberculous patients (every 3 months); and (g) annual re-survey of the entire, presumably nontuberculous population of mental institutions.

The first case-finding program of any kind

Table 1. Tuberculosis death rates in California mental hospitals, 1938-51

Year	Average population	Number of admissions	Number of tuberculosis deaths	Tuberculosis death rate per 100,000	Change in death rate from preceding year (percent)
1938..	21, 281	6, 957	144	677	-----
1939..	22, 200	7, 042	125	563	- 17
1940..	22, 853	7, 024	115	502	- 11
1941..	23, 055	7, 192	133	576	+ 15
1942..	23, 541	7, 694	128	545	- 5
1943..	23, 961	7, 658	136	568	+ 4
1944..	24, 573	7, 378	148	607	+ 7
1945..	25, 385	8, 166	169	667	+ 10
1946..	26, 101	8, 682	209	800	+ 20
1947..	26, 796	9, 349	199	743	- 7
1948..	28, 420	10, 644	190	668	- 10
1949..	29, 675	12, 137	172	580	- 13
1950..	30, 861	12, 398	149	482	- 19
1951..	33, 288	12, 567	122	366	- 24

Table 2. Tuberculosis death rates in California institutions for the mentally deficient, 1938-51

Year	Average population	Number of tuberculosis deaths	Tuberculosis death rate per 100,000	Change in death rate from preceding year (percent)
1938.....	3, 723	15	403	-----
1939.....	3, 840	20	521	+ 29
1940.....	3, 950	21	532	+ 2
1941.....	4, 279	21	491	- 8
1942.....	4, 547	17	363	- 17
1943.....	4, 738	28	591	+ 58
1944.....	4, 782	13	272	- 54
1945.....	4, 951	16	323	+ 19
1946.....	5, 078	13	256	- 21
1947.....	5, 326	8	152	+ 41
1948.....	5, 741	19	331	+ 118
1949.....	6, 205	10	161	- 51
1950.....	6, 467	9	139	- 13
1951.....	6, 541	4	61	- 56

in California's mental institutions was instituted in 1934 at Sonoma State Hospital (for the mentally deficient). Butler (6) initiated a program of tuberculin testing, X-raying of positive reactors, annual fluoroscopic surveys, segregation, and treatment. In 1943 plans were laid for an active case-finding program (7). Kupka (8) and Smith (9) carried out limited fluoroscopic and X-ray surveys in several institutions. With the purchase of mobile X-ray equipment in 1946, a continuing annual X-ray survey program was started.

In the initial survey (1), a prevalence of 8.25 percent of previously unrecognized, reinfection type, pulmonary tuberculosis was discovered among 25,914 mentally ill patients; a lower prevalence, 1.2 percent, was found among 4,798 mentally deficient patients. Approximately half of these patients were found to have active disease requiring segregation and treatment. Since sufficient central facilities for the tuberculous, mentally ill patients were not then available, it was necessary for each superintendent to redistribute the overcrowded patient population to provide the ward space needed for each group of tuberculous patients.

Prevailing conditions made this task of segregation tremendously difficult. Existing wards and buildings were not adapted to the care of tuberculous patients. In a few instances, although wards had been provided for

Table 3. Previously unrecognized cases of pulmonary tuberculosis in four annual resurveys of patients X-rayed in nine California mental hospitals, 1947-51

Type of case	Resurveys			
	1st ¹	2d	3d	4th
Not X-rayed previously (on leave, new admittance without X-ray, etc.)-----	38	29	34	26
Lesion seen in preceding survey film but interpreted differently-----	13	7	5	3
Small discrete lesion probably present in preceding survey film but not seen because of technical factors-----	40	14	21	23
Lesion in current survey missed in preceding survey film-----	5	3	1	2
Negative miniature film in preceding survey or on admission since preceding survey (new case) ² -----	124	80	43	52
Total cases ³ -----	220	133	104	106
Percent-----	0.83	0.50	0.38	0.37
Total ⁴ -----	26,452	26,502	27,196	28,937

¹ The findings in the first survey in DeWitt and Modesto State Hospitals are placed with the second survey of other hospitals, since all these patients had been transferred from other State hospitals.

² A new case is defined as a patient with X-ray evidence of tuberculosis in the current survey film whose earlier film or films, by direct comparison, showed an absence of the lesion.

³ Number of patients with X-ray evidence of previously unrecognized pulmonary tuberculosis.

⁴ Excluding previously diagnosed cases but including new admissions since previous survey.

the tuberculous patients, bathroom facilities and courtyards had to be used commonly by tuberculous and nontuberculous patients. Attendants and doctors were sometimes fearful of caring for tuberculous patients. A modified contagious disease technique was initiated, but execution was difficult because of the lack of trained personnel and suitably equipped buildings. However, these difficulties were gradually overcome, and effective segregation areas finally were created in most of the hospitals.

The initial survey of all the mental institutions required a year. Then a second round of surveys was begun, with resurveys being made at approximately yearly intervals by means of two mobile units. Two hospitals (DeWitt and

Modesto) have been added to the system since 1946, making a total of 11 institutions. At the time of their opening these 2 hospitals were filled by transfer of both mentally ill and mentally deficient patients from other hospitals, rather than by admission from the general population. New construction at most of the hospitals has brought about a decrease in the degree of overcrowding—based on a desirable standard of floor space per patient—from 24.5 percent in the mental hospitals and 26.9 percent in institutions for the mentally deficient to approximately 15 percent in all institutions. The total capacity of mental institutions has been increased from 26,092 in 1946 to 32,979 in 1951 and the capacity of hospitals for the mentally deficient has been increased from 5,078 to 6,627.

The number of admissions during the past 10 years has increased faster than the State population. Annual admissions and readmissions increased from 9,349 in 1947 to 12,567 in 1951—34 percent (table 1). State population during this period increased only from 9,535,000 to 10,602,000—11 percent. The median age of first admissions increased from 43.9 in 1938 to 46.4 in 1949, then dropped to 44.2 in 1951. These fluctuations were due to changes in policy in admitting harmless senile patients. About one-fifth of the resident mentally ill patients are over 65 years of age.

Results of Resurveys

Mentally Ill Patients

In each of the four resurveys reported here, all cases previously diagnosed as active or inactive tuberculosis (whether made in the initial survey or by the hospitals) have been excluded. Cases discovered in the first resurvey (table 3) dropped to one-tenth of those revealed by the initial survey, that is, to 0.83 percent. This was expected, since the findings in the initial survey were the accumulation of many years rather than of a single year. The third survey showed a further decrease to 0.50 percent; and the fourth and fifth surveys, to 0.38 and 0.37 percent, respectively.

These results are similar to those obtained elsewhere. In New York State, Katz and co-workers (10) reported an average annual incidence rate of 0.45 percent for the second

Table 4. Previously unrecognized cases of pulmonary tuberculosis in four annual resurveys of patients in four California institutions for the mentally deficient, 1947-51

Type of case	Resurveys			
	1st ¹	2d	3d	4th
Not X-rayed previously (on leave, new admittance without X-ray).....	0	2	0	0
Lesion seen in preceding survey film but interpreted differently.....	2	0	0	0
Small discrete lesion probably present in preceding survey film but not seen because of technical factors.....	1	0	0	1
Lesion in current survey missed in preceding survey film.....	0	0	0	0
Negative miniature film in preceding survey or on admission since preceding survey (new case) ²	18	8	10	10
Total cases ³.....	21	10	10	11
Percent.....	0.37	0.18	0.16	0.17
Total ⁴.....	5,695	5,571	6,104	6,554

^{1 2 3 4} See corresponding footnote for table 3.

survey (4 years in completion) and 0.32 percent for the third survey. Clark and Weber (11) in Ontario reported a steady decrease in new cases from 1.2 percent in their second annual survey (1939) to 0.22 percent in their 14th survey.

Mentally Deficient Patients

In the institutions for the mentally deficient, the initial survey revealed a 1.2 percent prevalence of tuberculosis, a rate which was lower than among the mentally ill. This was attributed chiefly to the much lower median age of mental defectives at the time of admission (15 years of age compared with 45 years for the mentally ill) (1). The second survey of mentally deficient patients showed a drop in the survey-discovered cases to 0.37 percent (table 4). The third survey revealed a further drop to 0.18 percent, with the last two surveys showing 0.16 and 0.17 percent, respectively.

Employees

The initial survey (1) revealed that 1.4 percent of the employees in mental institutions had

X-ray evidence of pulmonary tuberculosis. How many of these represented new infections or active disease is unknown, as it was impossible to follow up these employees through their private physicians. In the second survey, X-ray evidence consistent with active pulmonary tuberculosis was found in 0.2 percent of employees so examined. The three succeeding surveys revealed that 0.09, 0.04 and 0.05 percent, respectively, had evidence suggesting recent tuberculosis (table 5). Earlier 14" x 17" films had been negative in the 20 survey-discovered cases.

Analysis of Survey-Discovered Cases

Some of the survey-discovered cases in each resurvey had X-rays showing what appeared to be fibrotic or calcific lesions. It appeared obvious that these were not instances of new infection but were of longer standing. On investigation, it was found that in the four resurveys 0.09 to 0.14 percent of the total patients surveyed had not been X-rayed in the previous survey. Nearly all of these patients had been admitted at or very near the time of the resurvey and the film taken for the resurvey thus had served as an admission film. This accounted for part of these calcific and fibrotic

Table 5. Previously unrecognized cases of pulmonary tuberculosis found in four annual resurveys among employees of 10¹ California mental institutions, 1947-51

Institution	Resurveys				
	1st	2d	3d	4th	Total
Agnews.....	0	1	0	0	1
Camarillo.....	0	1	1	0	2
Mendocino.....	0	0	0	0	0
Modesto.....	2	0	0	0	2
Napa.....	2	0	0	1	3
Norwalk.....	1	0	0	0	1
Pacific Colony.....	0	0	0	0	0
Patton.....	2	2	0	2	6
Sonoma.....	0	0	0	0	0
Stockton.....	3	1	1	0	5
Total cases found.....	10	5	2	3	20
Total patients X-rayed.....	4,984	5,364	5,665	6,065	-----
Percentage X-rayed.....	0.20	0.09	0.04	0.05	-----

¹ One institution, which X-rayed employees annually with 14" x 17" films, is not included in this table.

appearing lesions. In the remainder, an earlier miniature survey film or a 14" x 17" film was located for comparison, the results of which are to be described.

In a very few instances (0.01 to 0.05 percent), the lesion, found on resurvey, had been seen previously but had been diagnosed differently—usually as a healed primary lesion in one survey and as minimal, fibrotic reinfection tuberculosis in the next. In one instance, unhappily, a basal lesion was diagnosed as pneumonia in the earlier survey film; the patient was neither X-rayed again nor followed up during the year; and, in the succeeding survey, there had been extensive spread through both lungs, with cavity formation. This patient died later of advanced tuberculosis.

In one group, on re-examining the preceding survey film, one could not be entirely certain whether or not the lesion discovered in the current survey had been present previously. In nearly all of these instances, the lesion seen in the current film was in the form of small, discrete nodules or fine, fibrotic strands. In the earlier film, the small lesion was partially or completely obscured by clavicle, rib, or scapula, or made invisible by undue darkness or lightness of the film, rotation, or movement. Yet the characteristics of the lesion in the current 14" x 17" film suggested that it must have been of long standing, and probably would have been evident in the earlier survey film, had an entirely satisfactory film been obtained.

Sometimes, the partially obscured lesion was discernible upon close comparison with the current film. This group of cases could be considered as having been missed for technical reasons. Obviously, it is not always possible to secure films of restless, mentally ill patients that, technically, are as satisfactory as those of normal individuals. Unless one takes a certain calculated risk, the number of 14" x 17" confirmatory films required would be much higher than our current 5 to 6 percent.

Missed Lesions

In another group, fortunately small, re-examination of the miniature film of the previous year revealed in contrast to the above group of cases, the presence of definite infiltration in a part of the lungs where it was clearly

visible even without reference to the later film. In other words, these lesions had been missed outright. In the second survey, there were five such instances (0.02 percent of the total number of patients X-rayed). Six cases were missed in the three succeeding surveys.

New Lesions

There remains for consideration the most important group, for which the resurveys are conducted, the "new" cases. These are specified as individuals whose current films present findings consistent with recent, active pulmonary tuberculosis and whose earlier films (within a year's interval) had been radiologically clear. Even in retrospect and upon careful comparison with the current resurvey film there was no X-ray evidence of tuberculous infiltration in the earlier film, either in the currently involved area or elsewhere. It would be desirable if laboratory proof in the finding of tubercle bacilli could have been included in the specification of these new cases. Chiefly, because sufficient laboratory personnel could not be obtained at the time of these resurveys, but also because of the inability of the mentally ill to cooperate in supplying suitable sputum specimens, this requirement of laboratory proof could not be insisted upon. Neither was there personnel to carry out tuberculin skin testing. In following all of these cases by X-ray, with serial films over a period of several years, these lesions persisted with clearing or progression and, in general, followed the usual course of tuberculous lesions.

Discussion

It should be stressed that the significance of findings in resurveys in tuberculosis case-finding programs differs basically from the significance of findings in the initial survey, in that the first survey revealed the prevalence of cases of tuberculosis which had accumulated over the years, through admission of patients with undiagnosed tuberculosis and transmission of the disease from these patients to others in the greatly overcrowded conditions once prevalent in mental institutions. In the resurveys, about half the patients with survey-discovered tuberculosis, by every test that could be applied under the then existing circumstances, had either ac-

quired or developed their tuberculosis in the interval since the previous survey. The possibility exists that some of these patients may have had microscopic lesions in earlier films, too small to be recognized even in retrospect.

The group designated as "new cases" cannot be used to compute a tuberculosis attack rate or an incidence rate for the reason that these cases do not constitute the total number of cases diagnosed in the mental institutions. Some new cases arising after admission to the institutions were diagnosed by the hospital staffs because of symptoms, such as loss of weight and fever. The total number of patients resurveyed each time included all those found to be negative in the preceding survey plus those admitted during this interval with negative chest X-rays. Omitted, of course, were those who were discharged or who had died since the preceding survey, as well as those who were both admitted and discharged during this period. It is apparent that, although continuing tuberculosis surveys in mental institutions show a diminishing return in numbers of new cases, these data are insufficient per se to justify an assumption of decreasing incidence.

Both the number of survey-discovered cases and the total number of cases reported by all the mental institutions from all sources have shown a leveling off after the rise resulting from the initial survey (commencing with 1948). Although the cause of this plateau in the number of reported cases is obscure, one must consider that this indicates the possibility of the persistence of one or more of the loopholes of infection among which the following have been noted:

1. Reactivation of supposedly inactive tuberculous lesions: (a) visible to X-ray; (b) invisible to X-ray, with the presumption that infection occurred previous to admission or to the earlier survey but that the lesion was not active or visible to X-ray.

2. Occasional failure to X-ray newly admitted patients.

3. Missed cases in surveys or admission X-rays.

4. Deficiencies in segregation: (a) inadequate physical facilities; (b) insufficient personnel; (c) untrained personnel (employee or

patient-worker); (d) delay in segregation or underestimating the need for segregation among new admittances or survey-discovered cases because of minimal extent of disease, apparent fibrotic character of lesions, lack of symptoms, failure to find tubercle bacilli, lack of bed space on the tuberculosis wards, losing sight of the patient, and reluctance to lose a "good worker."

It is important that the identification of significant tuberculosis and segregation of these patients be carried out as expeditiously as possible (12). In our institutions, patients with miniature-film evidence suggesting tuberculosis are X-rayed on 14" x 17" films by the mobile unit while the survey is still in progress. These films are interpreted promptly by the State health department roentgenologist and turned over to the hospital staff with a tentative X-ray impression and a recommendation regarding the need for segregation. These findings are usually followed until they can be supplemented by sputum examination, clinical observation, and serial X-ray examination, and until the best disposition of the patient can be determined. It is wise to err on the side of safety in these determinations (5).

Tuberculosis Death Rate

The tuberculosis death rate is an important index of the long-range effectiveness of any tuberculosis control program in a given area or group. In the progressive decline in the death rate from tuberculosis in this country, the total control program has unquestionably been a major factor. In contrast to this fortunate trend, the death rate for tuberculosis in California mental institutions remained quite high and, until recent years, showed little tendency to decline. There was a downward trend from 1922 to 1938 (1). However, between 1938 and 1946 there was actually an 18-percent increase, culminating in the 1946 peak rate of 800 per 100,000 (table 1). During this latter period, there was an increasing awareness of tuberculosis as a serious health problem in mental institutions; and this awareness, resulting in more accurate reporting of the cause of death, undoubtedly was a factor in the increase in the reported tuberculosis death rate in mental institutions between 1943 and 1946. On the other hand, the tuberculosis death rate for California

dropped 29 percent during the same period—from 60.5 to 42.9.

In contrast to the rising tuberculosis death rate among the mentally ill from 1936 to 1946, there was a gratifying reversal in trend following the initial survey in 1946. The death rate dropped from 800 in that year to 366 in 1951, a 54-percent decrease which, incidentally, is similar percentage-wise to the decrease in the tuberculosis death rate for the State during the same period (from 42.9 to 19.4). The situation was more favorable among the mentally deficient; the tuberculosis death rate had not been as high for them as for the mentally ill. From a maximum of 798 per 100,000 (1927-31), the rate has shown a general downward trend, becoming quite pronounced since 1948 (table 2). The 1951 rate of 61 per 100,000 is only a little over three times the rate for the State as a whole.

Although, as Anderson pointed out (13), it is impossible to attain complete statistical accuracy in a group this size, the trend appears to indicate a greatly improved situation which presumably has a direct and significant connection with the entire control program in the mental institutions in the State, including case finding, segregation, and treatment. Since treatment of these patients had not been intensive during the period before 1952, the preventive aspect of the program (reducing contact between patients with active tuberculosis and nontuberculous patients and, therefore, incidence of new cases) probably should be credited with the major part of this favorable change, as Katz has suggested (14). Whether we can expect the results of this program to catch up with the results of the program in the general population of the State or even in the general hospitals is open to some question. The death rate in the general population includes all ages, while the population of mental hospitals (especially for the mentally ill) represents a distinctly older age group in which the tuberculosis death rate would naturally be considerably higher than the death rate for the all-age group.

Some reports indicate that mental patients respond to treatment of their tuberculosis as well as nonmental patients with the same amount and type of tuberculosis (15, 16). On

the other hand, the Sunmount study suggested that emotional factors materially and unfavorably influence the reaction or response of the individual to his tuberculosis (17). In any case, the fact that the tuberculosis death rate among the mentally ill in 1951 was still high shows the need for continued, unremitting prosecution of case finding and segregation of patients with communicable or potentially communicable disease and for active treatment by every means which can be applied.

Pleasure's experience in Central Islip State Hospital, Central Islip, N. Y., to mention only one example, is pertinent in showing the need for continued case finding (18). After an initial survey of over 7,000 patients in this mental hospital in 1941, an active control program was put into effect. Not only were 132 new cases discovered by resurvey in 1946, but 134 other new cases of tuberculosis were diagnosed through clinical methods during the 5-year period. Furthermore, autopsies revealed 10 deaths from tuberculosis in patients not suspected of having the disease, and in 9 patients who died from other causes, tuberculosis was an incidental finding. Pleasure expressed the following convictions: Unsegregated patients with supposedly arrested tuberculosis should be X-rayed frequently; they should be kept in special wards; weight loss or other clinical findings are totally inadequate for case finding; a 5-year period is too long between surveys; patients in wards or buildings where a high prevalence or incidence of tuberculosis exists should be surveyed more frequently than annually (perhaps every 4 months); and patients with endobronchial lesions may be carriers even though they have a negative X-ray. The author agrees completely with these convictions. The complexity of the factors involved in an adequate control program in mental institutions dictates the necessity of maintaining constant vigilance in the case-finding and segregation program, supplemented by every applicable means of treatment.

Employees

Fifteen of the 20 cases of tuberculosis discovered among employees in the resurveys were hospital attendants (psychiatric technicians). The others were a registered nurse, a laboratory

attendant, a laundry employee, a stenographer, and a painter. Only 3 of the psychiatric attendants had been assigned to tuberculosis wards. Half of the total number of cases were revealed in the second survey, soon after or during the segregation of patients from the first survey. Thus, the presumption is strong that infection may have been derived largely from unsegregated patients during the period prior to the completion of segregation resulting from the initial survey. Fourteen of these 20 employees made application for compensation by the Industrial Accident Commission because of tuberculosis acquired in the course of their work; only one was denied compensation (table 6).

The survey-discovered cases represent only part of the cases diagnosed among employees. Between 1938 and 1951 a total of 71 employees of California mental institutions were awarded compensation by the Industrial Accident Commission. During the 6-year survey period, more than twice as many cases per year (survey- and nonsurvey-discovered) were awarded compensation than during the 8-year presurvey period. This suggests greater consciousness and better discovery of tuberculosis on the part of employees and physicians, since there was no essential change in the proportion of cases accepted by the Industrial Accident Commission.

"Missed" Cases

As Garland has said, "The interpretation of roentgenograms, as in other clinical methods and diagnostic aids, is subject to a certain degree of inherent error" (19). The character and location of the infiltration probably were factors in the missing of lesions in our surveys. The infiltration in seven cases was soft and hazy in appearance; the density was not great, but it was readily discernible on reinspection of the miniature film. These lesions were located below the clavicle and quite well laterally in the upper lobe. The missed lesions in the four other cases were apical or subapical, but located more mesially. They were less diffuse, slightly more dense, and probably were confused with the tip of the first rib or a transverse process. However, in retrospect they were easily distinguishable.

Since the standard for missed lesions, in this

Table 6. Number of employees of mental institutions applying to the California Compensation Insurance Fund because of diagnosis of tuberculosis, 1938-51

Diagnosis period	Applying for compensation	Awarded compensation	Rejected	Not applying
Presurvey period (1938-45)-----	32	26	8	(1)
Survey period (1946-51)-----	57	45	12	(1)
Discovered by first survey (1946)-----	7	6	1	27
Discovered by second to fifth surveys (1947-51)---	14	13	1	6
Discovered by non-survey methods---	36	26	10	(1)

¹ Not available.

SOURCE: California Compensation Insurance Fund, correspondence.

report, is the finding of lesions in subsequent examinations, it is possible that a few patients with undetected lesions were discharged between surveys. It is also possible that other missed lesions would have been discovered had double reading been practicable.

Conclusions

1. Mental institutions constitute one of the greatest existing reservoirs of active tuberculosis in this country. This reservoir has important epidemiological significance in relation to the general population.

2. Rapid and complete X-ray survey of mental hospital populations, with adequate segregation and treatment, is essential to a control program.

3. Four annual resurveys of the patients in mental institutions in California have revealed a diminishing, but significant, number of cases of previously unrecognized, pulmonary tuberculosis.

4. These findings, which are considered to be the result of "loopholes of infection," indicate the need for unremitting, active prosecution of the entire control program. Essential to such a program are a closely controlled hospital-admission X-ray program and an annual X-ray resurvey of the entire hospital population, with

adequate segregation of those patients requiring it.

5. An annual survey program among employees in the California mental institutions revealed a decreasing number with X-ray evidence of previously unrecognized, pulmonary tuberculosis. However, some new cases were diagnosed outside the institutional surveys. The data available are insufficient to formulate any idea regarding a trend in incidence.

6. The long-range effectiveness of the tuberculosis control program in mental institutions in California is reflected in the declining tuberculosis death rate. During the period from 1946 to 1951, the death rate among mentally ill patients decreased 54 percent—from 800 to 366 per 100,000. For the same period the death rate among the mentally deficient decreased 76 percent—from 256 to 61 per 100,000. These decreases are in sharp contrast to the trend prior to 1946. Comparison with rates for the general population must take into account the radical differences in age structure of these groups.

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